ORIGINAL

BEFORE THE

Federal Communications Commission

WASHINGTON, D.C. 20554

In the Matter of	)	
	)	
Amendment of Parts 2, 22, 90	)	
and 94 of the Commission's Rules	)	**RM-_____**
and Regulations to Permit Routine	)	
Licensing and Use of	)	
Bi-Directional Signal Boosters	)	

To: The Commission

PETITION FOR RULE MAKING
OF TX RX SYSTEMS INC.

TX RX SYSTEMS INC.

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Dated: February 25, 1993

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SUMMARY

TX RX Systems, Inc. designs and manufactures radio signal boosters, amplifiers and related equipment, such as filters, multicouplers and combiners, which it sells to customers in the United States and Europe.

Radio signal boosters are used to fill in "dead spots" in the coverage area of private land mobile dispatch systems, private and common carrier paging systems, and multiple address systems operated in the Private Operational-Fixed Microwave Service. These dead spots might be found in tunnels, subterranean parking facilities, cargo ships, aircraft hangars and the like. A signal booster does not extend the geographic coverage area of the radio system. Rather, it enables the signal to reach parts of the coverage area that are otherwise blocked by terrain or man-made structures.

To minimize the paperwork burden on both the Commission as well as applicants and licensees, petitioner suggests a regulatory approach similar to that which has been employed to authorize the operation of radar units under a police department's basic dispatch license. A

separate license would not be required, so long as the signal booster has been type accepted by the Commission.

There is an increasing demand for this type of equipment as service providers and customers are more and more expecting ubiquitous and uniform communications coverage. Accordingly, adoption of the proposed rules would serve the public interest.

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To: The Commission

PETITION FOR RULE MAKING OF TX RX SYSTEMS INC.

TX RX Systems Inc. ("TX RX"), pursuant to Section 1.401 of the Rules and Regulations of the Federal Communications Commission ("FCC" or "Commission"), hereby respectfully submits this Petition for Rule Making ("Petition") requesting amendment of Parts 2, 22, 90, and 94 of the FCC's Rules and Regulations to permit Commission licensees to routinely use bi-directional signal boosters.

I. PRELIMINARY STATEMENT

1. TX RX Systems Inc. designs and manufactures radio signal boosters, amplifiers and related equipment which is employed by users in both the private land mobile and public mobile radio services to enhance the utility of their telecommunications systems. TX RX is one of the nation's

leading manufacturers of signal boosters and currently holds type acceptance authorizations from the Commission for various non-broadcast transmitters and signal boosters.

2. TX RX also manufactures other high performance system devices such as filters, multicouplers and combiners. TX RX displays its equipment at major radio equipment and vendor shows throughout the United States and is engaged in a constant effort to pioneer equipment that will promote more efficient use of the radio spectrum and enhance the utility of radio for the individual user. The company has its headquarters in Angola, New York and distributes radio equipment to customers throughout the United States and Europe.

II. BACKGROUND

3. Over the past decade, TX RX Systems Inc. has recognized and responded to the specialized and constantly expanding market demand for radio equipment that will extend the utility of non-broadcast fixed and mobile radio systems in the United States. TX RX has emerged as one of the nation's leading manufacturers of non-broadcast signal boosters and amplifiers.

4. The impetus for the instant Petition for Rule Making stems from two mutually reinforcing phenomena: (1) industry's constantly increasing demand for reliable communications capability in a variety of shielded environments which are otherwise impervious to radio transmissions, and (2) the corresponding increase in the technical sophistication and versatility of equipment designed to amplify radio signals. TX RX believes that the time has come for the Commission to formally recognize the role of signal boosters in enhancing radio use. More importantly, the time has come to ease the regulatory burdens which the Commission's rules impose on licensees employing signal boosters as part of routine day-to-day operation of their radio systems.

5. In recognition of the factors identified above, this Petition for Rule Making seeks to establish specific provisions under Parts 2, 22, 90 and 94 of the Commission's Rules and Regulations to permit the routine operation of signal boosters. TX RX believes there is a bona fide need for operation of signal boosters in conjunction with a variety of radio services, including common carrier paging operations at 931-932 MHz, two-way private land mobile radio systems in the bands 150-174 MHz, 470-512 MHz, 800 MHz and 900 MHz, private radio paging operations at 929-930 MHz, and

multiple address systems ("MAS") operated in the Private Operational-Fixed Microwave Service. Accordingly, TX RX hereby petitions the Commission to institute a rule making proceeding for the purpose of implementing appropriate changes in Parts 2, 22, 90, and 94 of its rules.

III. DISCUSSION

A. Overview

6. In purpose and function, a booster provides additional signal coverage in areas where the normal, non-boosted signal would be adequate if there were no obstructions preventing reception of the radio signal. To cite a few examples, signal boosters can be used to ensure that portable transceiver units associated with two-way land mobile radio systems can be used inside cargo ships and other vessels, tunnels, subways, subterranean structures, nuclear power plants, open pit coal mines, canyons, parking ramps and garages.1/ By definition, signal boosters do not

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1/ In multiple level structures and tunnel-like applications, one signal booster may not be adequate. In such cases, multiple signal boosters could be used in series. It is general practice to configure the series of boosters in such a way that the one signal booster which talks to the "outside world" handles the bulk of the signal level differentials and the other signal boosters are very

(continued...)

extend the originally transmitted signal beyond the previously established service area.

B. Prior Signal Booster Rule Making in the Private Land Mobile Radio Services

7. The Commission amended the rules governing the private land mobile radio services in 1971 to permit use of signal boosters on ten frequency pairs in the band 450-470 MHz.[2/] This rule amendment was implemented at the request of United Air Lines, which found that the use of signal boosters was essential for effective radio communications relating to the servicing and supply of aircraft at air terminals. When adopting the provisions for signal boosters in the Business Radio Service, the Commission rejected United Air Lines' request to permit the

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1/(...continued)
similar in gain and output power settings. For example, signal boosters spaced at 2000-foot intervals in a tunnel and connected through Radiax-type cables can be balanced to match the consistent losses between signal boosters, making them all the same in configuration.

2/ The frequency pairs available for operation of signal boosters are 460/465.650 MHz, 460/465.675 MHz, 460/465.700 MHz, 460/465.725 MHz, 460/465.750 MHz, 460/465.775 MHz, 460/465.800 MHz, 460/465.825 MHz, 460/465.850 MHz, 460/465.875 MHz. These frequency pairs are allocated exclusively to the Business Radio Service and are available solely for communications incidental to aircraft operations at major commercial airports. See Section 90.75(c)(25), 47 C.F.R. 90.75(c)(25) (1990).

use of signal boosters on all Business Radio Service frequencies.[3] The Commission determined that it was desirable to evaluate the experience gained as a result of limited operation on the ten air terminal channels before assessing "the propriety of extending the use of boosters."[4]

8. In the intervening period between 1971 and the present, the Commission has not taken any further action to extend the use of signal boosters in the Private Land Mobile Radio Services. As noted above, given advancements in the technology of signal boosters and the requirements of radio users for a more ubiquitous service, TX RX believes that it is particularly appropriate for the Commission to examine, at this time, "the propriety of extending the use of boosters."

3/ Report and Order, In the Matter of Amendment of the Commission's Rules to Permit Base Station Signal Boosters on Frequencies Allocated for Air Terminal Use, Docket No. 18626, adopted April 8, 1971, 28 FCC 2d 479 (1971).

4/ Id. at 482. As best as the Petitioner has been able to determine, there is no record of interference cases involving aberrant transmissions resulting from the operation of signal boosters in the Business Radio Service during the period 1971 to the present.

C. Prior Signal Booster Rule Making in the Domestic Public Land Mobile Service

9. In 1991 the Commission amended the rules governing the Domestic Public Cellular Radio Service to permit cellular licensees to use signal boosters as a means of correcting problems of poor coverage.[5/] In reaching this decision, the Commission concluded that cell boosters or "enhancers" would enable cellular licensees to fill in areas of poor coverage associated with an existing cell site and would provide a more economical way to increase coverage in new locations.[6/]

10. Significantly, the Commission's decision noted that cell boosters had proven that they could improve the coverage of cellular systems without any documented cases of interference.[7/] In implementing the rules for cell boosters,[8/] the Commission relied principally on the type

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5/ Report and Order (FCC 91-399), CC Docket No. 88-411, adopted December 12, 1991, 57 Fed. Reg. 830 (January 9, 1992).

6/ Id. at paragraph 17.

7/ Report and Order, CC Docket No. 88-411, at paragraph 14.

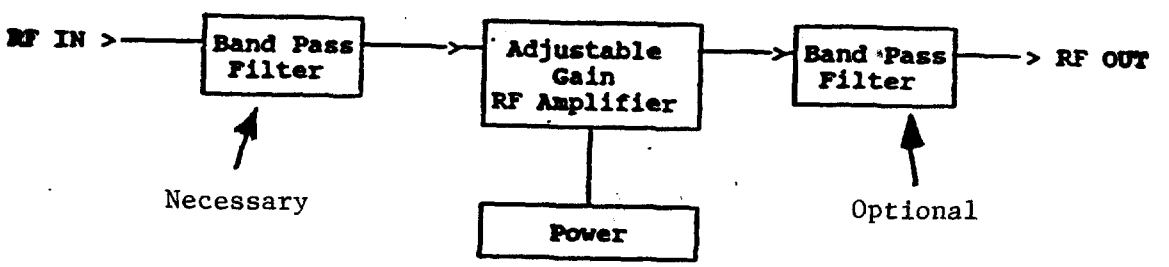
8/ The Report and Order in CC Docket 88-411 uses the term "cellular repeater" rather than cell "enhancer" or "booster." Since these devices are used both to improve

(continued...)

acceptance process to protect against any harmful interference that might be caused by these boosters. Once a cell booster has been type accepted, a cellular licensee merely needs to notify the Commission, using FCC Form 489, that it will use a booster or repeater.9/

D. The Technology of Signal Boosters

11. A signal booster is a device which can be used to improve communications in areas where normal radio transmissions are blocked due to natural or man-made obstacles. A signal booster is basically an RF gain block or amplifier with the passband determined by band pass filters. A one-way signal booster is organized as follows:



8/(...continued)
coverage and to provide coverage in new locations, the Commission found that "cellular repeater" more aptly described the broader function of these devices.

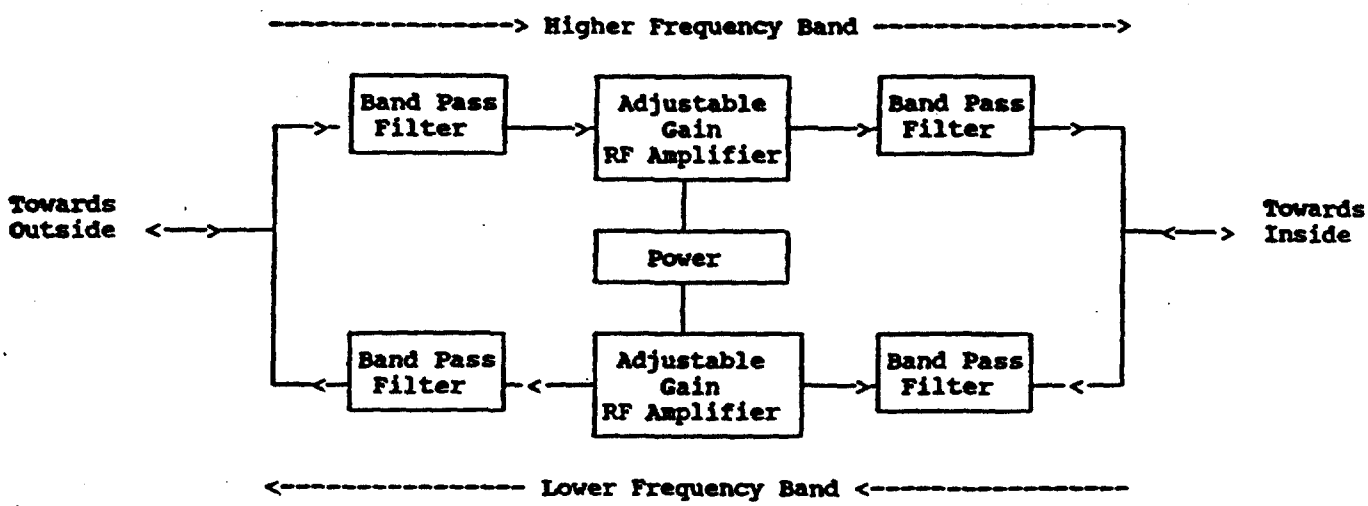
9/ The notification process applies only in cases where the repeater will not extend the licensee's signal beyond the authorized Cellular Geographic Service Area (CGSA). If the repeater is being used to extend the cellular signal beyond the CGSA, the normal licensing requirements apply. Report and Order, CC Docket No. 88-411, at paragraph 19.

the maximum power output is determined by the RF amplifier, which is a class A linear-type amplifier. Preamplifiers may be included to increase the signal booster gain.

13. The level of the RF output signal allowed on any one frequency is determined by the number and level of all signals presented to the RF amplifier. In cases where there is a potential for large signal variation or where unwanted signals may be received from off-the-air sources,[11/] signal boosters typically employ "output level control circuitry."

11/ As indicated in the Appendix, TX RX proposes two distinct classes of signal boosters. The first class, referred to as Class A ("narrowband") boosters, would consist of devices which rely on frequency conversion and filtering techniques to ensure that only those discrete signals intended to be retransmitted are actually amplified. With a Class A device, the frequencies intended to be retransmitted undergo frequency conversion within the confines of the booster itself, although the output frequencies are identical to the input frequencies. In this situation, the frequency conversion which takes place within the booster is essential to ensuring that the booster amplifies only those frequencies intended to be retransmitted. Therefore, with Class A boosters, the booster design ensures that unwanted signals will not be amplified. The second class of boosters, referred to as Class B ("broadband") boosters, amplify whatever frequencies are received within the passband of the filter. Class B boosters are ideal for tunnels and other confined areas where the possibility of "foreign" signals being fed into the boosters is remote. TX RX suggests that it would be appropriate for the Commission to impose on licensees employing Class B boosters the responsibility for remedying any harmful interference which the amplified signals might cause to other systems.

Similarly, a two-way signal booster[10/] is organized as follows:



12. The operating frequency band and bandwidth of the signal booster is determined by the characteristics of the band pass filters or cavities. The band pass generally ranges from 250 kHz to 20 MHz and typically is between 2 MHz and 10 MHz. All signals within the band pass are amplified. For this reason, it is important to reduce the bandwidth to the minimum practical amount to maintain predictable operation. The amount of boost, otherwise called gain, and

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10/ Two-way radio signal boosters are inherently full duplex in nature and must operate with different frequencies in each direction of communications. A simplex frequency cannot be amplified in both directions. Different channels may be working in either direction at the same time as long as each direction falls within a common bandwidth "window."

14. Output level control circuitry ensures that the booster will not function outside of the Commission's spurious emission specification.12/ Viewed from this perspective, signal boosters are inherently self-regulating. When a licensee seeks to amplify additional signals, the output power for each signal diminishes if the total power exceeds the preset limit. This characteristic protects against the possibility that a booster will operate beyond design limits and FCC restrictions on spurious emissions. Signal booster gain normally ranges from +30 dB to +85 dB, limited only by amplifier technology and the ability to meet the Commission's spurious emission specifications.13/

12/ If the booster is connected to a controlled signal source, such as a transmitter multicoupler feeding a radiating cable, output level control circuitry is not necessary because the booster will be designed for a specific number of carriers and levels. This was the case, for example, with the signal boosters used in the construction of the tunnel under the English Channel separating the United Kingdom and continental Europe. TX RX supplied all of the signal boosters used for the English Channel tunnel.

13/ Limiting the permissible output power level for signal boosters ensures that the amplitude of intermodulation products remains within acceptable levels and prevents damage to the booster that might otherwise result when strong signals are emitted by transmitters in close proximity to the antenna system.

E. Comparison of Signal Boosters and Repeaters

15. A signal booster is similar, in certain respects, to a repeater station. There are, however, critical differences between signal boosters and repeaters. Unlike repeaters, signal boosters are neither designed nor intended to increase the geographic range of the transmitted signal. Nor does a signal booster result in transmitting the radio signal over a different radio frequency, as would a repeater. The RF output of the signal booster is the same as the input frequency received at the booster.14/ Therefore, users do not have to switch channels on their radios to operate on the boosted signals. Additionally, signal boosters can boost several radio channels at the same time. Thus, a signal booster is normally not as costly as a repeater operation, in which there is an individual repeater for each channel.

14/ TX RX is in the process, however, of obtaining type acceptance for signal boosters that use frequency conversion within the booster and convert back to the original frequency before the final amplification. This technique allows crystal filters to be used in the intermediate frequency stage for separating individual carriers, creating, in effect, a single channel booster. In this way, unwanted carriers will not be amplified.

16. A repeater is designed to provide radio coverage for the overall radio system and requires only a few microvolts of signal input. A signal booster, on the other hand, is designed to "fill-in" an area that would normally have very good signal levels. Therefore, signal boosters necessarily work with much higher input signal levels.

F. Significance of Routine Use of Signal Boosters

17. "Dead spots" in coverage have long plagued the point-to-multipoint or omnidirectional signals transmitted by both fixed and mobile radio systems. Recent advancements in signal booster technology provide a practical solution for dead spots. Equally important, the sophistication inherent in modern communications systems has reached the point where system planners and users both expect and demand the ability to feed radio signals into and out of locations heretofore considered impenetrable.15/

15/ For instance, the City of Burbank, California has adopted an ordinance requiring that all buildings, aside from single family homes and certain other limited exceptions, be equipped with a two-way radio transmitting and receiving amplification system capable of supporting "police, fire, paramedic, and other City emergency workers' radio communications from all portions of buildings, be it underground parking structures or high-rise stairwells."

18. TX RX believes that the decade of the 1990's, with the potentially explosive proliferation of personal communication devices, will place considerably more emphasis on radio users' access to communications systems. The pace of business and commerce in the coming years will require that individuals have communications capability at their disposal in all environments and irrespective of physical or structural obstacles.16/ In this environment, signal boosters will play a critical role in ensuring that users enjoy continuous access to their telecommunications systems.

19. Elimination of the existing regulatory impediments to the use of signal boosters would promote the larger and more effective use of radio, thereby serving the public interest. Accordingly, TX RX believes it is appropriate at

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16/ In December 1991 the City of Chicago issued its revised "Minimum Functional Requirements" ("MFR") for the Chicago Emergency Communications Center. Among other things, this document dictates specific design enhancements to be implemented in the city-wide public safety communications system in order to provide "maximum flexibility of operation and improved traffic throughput." The MFR mandates "city-wide in-structure coverage at 95%, both talk-in and talk-out . . . for all mobiles, portables and pagers within Chicago's area of operations for voice and data" systems in the frequency bands 150 MHz, 450 MHz and 800 MHz. By definition, the in-structure coverage requirement encompasses high-rise buildings, deep substructures, subways, and pedways. The first area of consideration in this effort will be the 4.2 mile underground pedway linking Michigan Avenue, Randolph Street, Washington Street, Madison Street, and Monroe Street in downtown Chicago.

this time for the Commission to amend its rules to facilitate more widespread and effective use of signal boosters.

G. Recommended Regulatory Approach to Signal Boosters

20. As indicated above, unlike the broader functions ascribed to cellular repeaters in CC Docket No. 88-411, signal boosters would not be used to increase the geographic range of a transmitted signal. Nor do signal boosters transmit the radio signal over a different frequency.17/ These factors, in and of themselves, serve to limit the impact of signal boosters upon co-channel systems in nearby areas. Under the circumstances, the petitioner does not believe there is a need for the operation of signal boosters to be reflected on the user's station authorization. TX RX anticipates that the authority to use signal boosters could

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17/ TX RX recognizes that there are unique situations, such as for trunked police and fire systems requiring coverage below ground, in which the licensee of a system may require use of a signal booster that does in fact translate the signal to a different frequency. For example, in cases where the filters used in a signal booster introduce a delay in retransmission of the direct signal, destructive interference may be caused to the direct signal at all portals above and below ground. The answer, assuming there are sufficient frequencies available, may be to translate the frequency. The signal booster would then have the capabilities of a repeater and, in the view of the petitioner, should be licensed as a repeater.

be conveyed in a manner similar to the provisions governing operation of police radar units under Part 90 of the Commission's rules.

21. Recognizing that individual licensing of radar units would impose an unnecessary paperwork burden on licensees, the Commission has determined that licensees of Part 90 two-way land mobile radio in the Public Safety Radio Services may operate an unlimited number of speed detection devices "without specific authorization from the Commission, provided type accepted equipment . . . is used and all other rule requirements are satisfied."[18/] Accordingly, TX RX proposes that in cases where a Commission licensee seeks to employ signal boosters to penetrate structures or other obstacles within the area customarily served by the licensee's system, the licensee would not require specific authorization from the Commission to operate such signal boosters, provided that the signal boosters have been previously type accepted.[19/]

18/ See, e.g., Section 90.19(g)(6) of the Commission's rules, 47 C.F.R. § 90.19(g)(6) (1990). The provisions governing unlicensed operation of radar units in the Public Safety Services were adopted by Report and Order, PR Docket No. 82-183, released November 19, 1982, 47 Fed. Red. 54450 (December 3, 1982).

19/ TX RX believes it would be appropriate, as a routine part of the type acceptance process, for the Commission to

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H. Specific Rule Sections To Be Amended

22. TX RX believes there is an immediate need to amend the rules governing the Part 90 private land mobile radio allocations in the bands 806-824/851-869 MHz and 896-901/935-940 MHz to facilitate the routine use of signal boosters. Additionally, TX RX proposes that the operation of signal boosters also be routinely permitted in conjunction with Part 90 private paging systems in the band 929-930 MHz. To accommodate the routine use of signal boosters in these three private land mobile radio bands, TX RX proposes that a new rule section, Section 90.219, be implemented under Part 90. The text of this rule is set forth in the attached Appendix.

23. TX RX also believes that licensees of Part 22 common carrier paging systems in the band 931-932 MHz should likewise have the flexibility to routinely employ signal boosters. Accordingly, TX RX proposes an appropriate amendment to Section 22.501(p) to extend the use of signal boosters to paging systems in the 931-932 MHz band.

19/(...continued)
require equipment manufacturers to provide test data demonstrating that any third order intermodulation products remain within acceptable limits.

Finally, TX RX urges the Commission to add a new section, Section 94.96, to the rules governing the Private Operational-Fixed Microwave Service to accommodate the use of signal boosters by private radio MAS licensees.

24. Accordingly, the amendments proposed by TX RX would result in the addition of two new rule sections to the Commission's rules, Section 90.219 and Section 94.96, as well as amendment of an existing section, Section 22.501.20/

IV. CONCLUSION

25. In recent years, the demand for regular two-way, paging and multiple address communications service inside man-made structures has increased dramatically. Signal boosters provide a very practical, cost-efficient solution to the "dead spots" which occur in these structures. To permit radio licensees to realize the full benefits of signal boosters without undue administrative delay, the

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20/ As with cell enhancer devices, the type acceptance process should be sufficient to ensure that signal boosters manufactured for use in conjunction with 800 MHz and 900 MHz private land mobile systems, paging systems in the bands 929-930 MHz and 931-932 MHz, and private multiple address systems at 900 MHz do not cause interference to other systems.

Commission's rules should be amended to permit routine use of signal boosters.

26. In this Petition, therefore, TX RX Systems Inc. urges the Commission to initiate a rule making proceeding aimed at amending Parts 2, 22, 90 and 94 of the Commission's Rules and Regulations to specifically provide users with the option of using signal boosters on a regular basis. TX RX proposes that signal boosters be routinely permitted in conjunction with two-way private land mobile radio systems in the frequency bands at 800 MHz and 900 MHz, private paging systems in the band 929-930 MHz, common carrier paging systems in the band 931-932 MHz, and private multiple address systems in the bands 928/952 MHz and 932/941 MHz.

WHEREFORE, THE PREMISES CONSIDERED, TX RX Systems Inc. respectfully urges the Federal Communications Commission to

grant this Petition for Rule Making and institute a rule making proceeding consistent with the proposals set forth in the attached Appendix.

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Dated: February 25, 1993

APPENDIX

I. Part 2 of Title 47 of the Code of Federal Regulations is proposed to be amended as follows:

PART 2 -- FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

1. The authority citation in Part 2 continues to read as follows:

Authority: 47 U.S.C. 154, 302, 303, and 307, unless otherwise noted.

2. Section 2.1 is amended by adding the term "signal booster" to the definitions contained therein, as follows:

Section 2.1 Terms and definitions.

* * * * *

Ship Station. ***

Signal Booster. A device which automatically receives, amplifies and retransmits, on a one-way or two-way basis, the signals received from base stations, mobile and portable units with no change in frequency or authorized bandwidth. A signal booster may be either narrowband (Class A), in which case the booster amplifies only those discrete frequencies intended to be retransmitted, or broadband (Class B), in which case all signals within the passband of the signal booster filter are amplified.

Simplex Operation. ***

* * * * *